This memorandum consists of 10 pages.
NOTE:
• If a candidate answers a question TWICE, only mark the FIRST attempt.
• If a candidate has crossed out an attempt of a question and not redone the question, mark the crossed out version.
• Consistent accuracy applies in ALL aspects of the marking memorandum.
• Assuming answers/values in order to solve a problem is NOT acceptable.

**QUESTION 1**

| 1.1 | \[
\text{Mean} = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{929}{19} = 48,89
\]
|     | \[
\text{answer}
\]
|     | (2)  |
| 1.2 | 31 ; 31 ; 34 ; 36 ; 37 ; 39 ; 40 ; 43 ; 46 ; 46 ; 48 ; 52 ; 56 ; 60 ; 62 ; 63 ; 65 ; 66 ; 74. |
|     | Median = 46 |
|     | \[
\text{arranging in ascending order}
\]
|     | \[
\text{median}
\]
|     | (2)  |
| 1.3 | Lower quartile = 37 |
|     | Upper quartile = 62 |
|     | \[
\text{lower quartile}
\]
|     | \[
\text{upper quartile}
\]
|     | (2)  |
| 1.4 | ![Box with median and whisker diagram]
|     | \[
\text{box with median}
\]
|     | \[
\text{whisker}
\]
|     | (2)  |
|     | [8]  |
QUESTION 2

2.1 The modal class is $2500 \leq x < 4500$

✓ $2500 \leq x < 4500$ (1)

2.2

<table>
<thead>
<tr>
<th>Gross Vehicle Mass (GVM) (in kg)</th>
<th>Frequency</th>
<th>Midpoint</th>
<th>Frequency $\times$ midpoint</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2500 \leq x &lt; 4500$</td>
<td>103</td>
<td>3500</td>
<td>360 500</td>
</tr>
<tr>
<td>$4500 \leq x &lt; 6500$</td>
<td>19</td>
<td>5500</td>
<td>104 500</td>
</tr>
<tr>
<td>$6500 \leq x &lt; 8500$</td>
<td>70</td>
<td>7500</td>
<td>525 000</td>
</tr>
<tr>
<td>$8500 \leq x &lt; 10500$</td>
<td>77</td>
<td>9500</td>
<td>731 500</td>
</tr>
<tr>
<td>$10500 \leq x &lt; 12500$</td>
<td>85</td>
<td>11500</td>
<td>977 500</td>
</tr>
<tr>
<td>$12500 \leq x &lt; 14500$</td>
<td>99</td>
<td>13500</td>
<td>1 336 500</td>
</tr>
<tr>
<td>Sum</td>
<td>453</td>
<td></td>
<td>4 035 500</td>
</tr>
</tbody>
</table>

Estimated mean $(\bar{X}) = \frac{4035 500}{453} = 8908.39$ kg.

✓ midpoints
✓ frequencies $\times$ midpoint
✓ $4 035 500$
✓ answer (5)

2.3 The estimated mean.
It is more at the centre of the data set. The modal class is found at the extreme left-hand side of the data set.

✓ estimated mean with reason (1) [7]
QUESTION 3

3.1.1

\[ DE = \sqrt{(-3 - 3)^2 + (3 - (-5))^2} \]
\[ = \sqrt{100} \]
\[ = 10 \]
✓ substitution into distance formula
✓ answer
(2)

3.1.2

\[ m_{DE} = \frac{-5 - 3}{3 - (-3)} \]
\[ = \frac{-8}{6} \]
\[ = -\frac{4}{3} \]
✓ substitution into gradient formula
✓ answer
(2)

3.1.3

\[ m_{EF} = \frac{3}{4} \]
\[ \text{EF} \perp \text{DE} \]
\[ \frac{-5 - k}{3 - (-1)} = \frac{3}{4} \]
\[ 4(-5 - k) = 3(3 - (-1)) \]
\[ -20 - 4k = 12 \]
\[ -4k = 32 \]
\[ k = -8 \]
✓ \( m_{EF} = \frac{3}{4} \)
✓ simplification
✓ \(-5 - k = \frac{3}{4} \)
✓ \(3 - (-1) = \frac{3}{4} \)
✓ \(k = -8 \)
(4)

3.1.4

\[ M(\frac{-3 + (-1)}{2}; \frac{3 + (-8)}{2}) \]
\[ = (-2; \frac{-5}{2}) \]
✓ substitution into midpoint formula
✓ answer
(2)
3.1.5 If DEFG is a rectangle then M is also the midpoint of EG. Let the coordinates of G be \((x; y)\)

\[
\left(\frac{x + 3}{2}; \frac{y - 5}{2}\right) = \left(-2; \frac{-5}{2}\right)
\]

\[
\frac{x + 3}{2} = -2 \quad \text{and} \quad \frac{y - 5}{2} = \frac{-5}{2}
\]

\[
x + 3 = -4 \quad \text{and} \quad y - 5 = -5
\]

\[
x = -7 \quad \text{and} \quad y = 0
\]

∴ G\((-7; 0)\)

**OR**

The translation that sends E\((3; -5)\) to F\((-1; -8)\) also sends D\((-3; 3)\) to G.

\((-1; -8) = (3 - 4; -5 - 3)\)

∴ G\((-3 - 4; 3 - 3) = (-7; 0)\)

**OR**

The translation that sends E\((3; -5)\) to D\((-3; 3)\) also sends F\((-1; -8)\) to G.

\((-3; 3) = (3 - 6; -5 + 8)\)

∴ G\((-1 - 6; -8 + 8) = (-7; 0)\)

3.2 \[\sqrt{(x - 1)^2 + (5 - (-2))^2} = \sqrt{53}\]

\[(x - 1)^2 + 49 = 53\]

\[x^2 - 2x + 1 + 49 - 53 = 0\]

\[x^2 - 2x - 3 = 0\]

\[(x + 1)(x - 3) = 0\]

\[x = -1 \quad \text{or} \quad x = 3\]

but D is in the second quadrant

∴ only \(x = -1\) is valid

\[\sqrt{x + 3}{2} = -2\]

\[\sqrt{x} = -7\]

\[\sqrt{y - 5}{2} = \frac{-5}{2}\]

\[\sqrt{y} = 0\]

**method**

\[x - 4\]

\[y - 3\]

\[\text{answer}\]

**method**

\[x - 6\]

\[y + 8\]

\[\text{answer}\]

**equation using distance formula**

**standard form**

**factorisation**

\[\text{answer must exclude 3}\]

\(4\)

\([18]\)
### QUESTION 4

#### 4.1.1
\[
\sin C = \frac{AB}{AC}
\]

✓ AC  \hspace{1cm} (1)

#### 4.1.2
\[
\cot A = \frac{AB}{BC}
\]

✓ \cot A  \hspace{1cm} (1)

#### 4.2
\[
\frac{\sin 60^\circ \cdot \tan 30^\circ}{\sec 45^\circ}
\]

✓✓ substitution

\[
= \frac{\left(\frac{\sqrt{3}}{2}\right) \left(\frac{1}{\sqrt{3}}\right)}{\sqrt{2}}
\]

✓ simplification

\[
= \frac{1}{2}\sqrt{2}
\]

✓ answer  \hspace{1cm} (4)

#### 4.3.1
\[
r^2 = (-5)^2 + (12)^2
\]

✓ \(r^2 = (-5)^2 + (12)^2\)

\[
r^2 = 169
\]

✓ \(r = 13\)

\[
cos \theta = \frac{-5}{13}
\]

✓ answer  \hspace{1cm} (3)

#### 4.3.2
\[
\cosec^2 \theta + 1
\]

✓ \(\frac{13}{12}\)

✓ simplification

✓ answer  \hspace{1cm} (3)

\[
= \left(\frac{13}{12}\right)^2 + 1
\]

\[
= \frac{169}{144} + \frac{144}{144}
\]

\[
= \frac{313}{144}
\]
**QUESTION 5**

<table>
<thead>
<tr>
<th>Sub-Question</th>
<th>Equation</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1.1</td>
<td>(5 \cos x = 3) [\cos x = \frac{3}{5}] [x = \cos^{-1}\left(\frac{3}{5}\right)] [x = 53,1^\circ]</td>
<td>✓</td>
</tr>
<tr>
<td>5.1.2</td>
<td>(\tan 2x = 1,19) [2x = \tan^{-1}(1,19)] [2x = 49,95845....^\circ] [x = 25^\circ]</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>5.1.3</td>
<td>(4 \sec x - 3 = 5) [4 \sec x = 8] [\sec x = 2] [\frac{1}{\sec x} = \frac{1}{2}] [\cos x = \frac{1}{2}] [x = \cos^{-1}\left(\frac{1}{2}\right)] [x = 60^\circ]</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>5.2.1</td>
<td>(\widehat{JKD} = 8^\circ) alternate angles</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>5.2.2</td>
<td>(\tan 8^\circ = \frac{5}{DK}) [DK = \frac{5}{\tan 8^\circ}] [DK = 35,57684.....km] [DK = 35 577 m]</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
<tr>
<td>5.2.3</td>
<td>(DS = 35,58 - 8 = 27,58) km</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>5.2.4</td>
<td>(\tan \widehat{DSJ} = \frac{5}{27,58}) [\widehat{DSJ} = \tan^{-1}\left(\frac{5}{27,58}\right)] [\widehat{DSJ} = 10,3^\circ]</td>
<td>✓ ✓ ✓ ✓</td>
</tr>
</tbody>
</table>
QUESTION 6

6.1.1

✓ correct x-intercepts
✓ correct y-intercept
✓ asymptotes
✓ shape (must pass through \(45^\circ; 2\))

\(y = -2 \tan x\)

✓ answer

6.2.1

\[g(x) = a \sin x\]

\[4 = a \sin 90^\circ\]

\[4 = a(1)\]

\[a = 4\]

✓ \(a = 4\)

6.2.2

Range is \(-2 \leq y \leq 6\).

✓ \(-2\)

✓ \(6\)
### QUESTION 7

| 7.1.1 | \( AH^2 = 0.8^2 + 1.5^2 \)  
      | \( AH^2 = 2.89 \)  
      | \( AH = 1.7 \) | ✓ \( AH^2 = 0.8^2 + 1.5^2 \)  
      | ✓ \( AH = 1.7 \)  
      |  (2) |
| 7.1.2 | Surface area of roof = \( 4 \times \frac{1}{2} (3 \times 1.7) \)  
      | = 10.2 \( \text{m}^2 \) | ✓ \( 4 \times \frac{1}{2} (3 \times 1.7) \)  
      | ✓ answer |  (2) |
| 7.1.3 | Surface area of walls = \( 4 \times 3 \times 2.1 \)  
      | = 25.2 \( \text{m}^2 \) | ✓ 25.2 \( \text{m}^2 \)  
      | ✓ answer |  (2) |
| 7.2.1 | Volume = \( \frac{4}{3} \pi (8)^3 \)  
      | = 2144.66 mm\(^3\) | ✓ \( \frac{4}{3} \pi (8)^3 \)  
      | ✓ answer |  (2) |
| 7.2.2 | New volume : original volume = \( 2^3 : 1 \)  
      | = 8 : 1 | ✓ \( 2^3 \)  
      | ✓ answer |  (2) |
| 7.2.3 | Volume including silver = \( \frac{4}{3} \pi (9)^3 \) = 3 053.63 mm\(^3\).  
      | Volume of silver = \( 3 053.63 - 2144.66 \)  
      | = 908.97 mm\(^3\) | ✓ \( \frac{4}{3} \pi (9)^3 \)  
      | ✓ answer |  (2)  
      | [12] |

### QUESTION 8

| 8.1 | OQ = 2 cm  
     | .... (the long diagonal of a kite bisects the shorter diagonal) | ✓ 2 cm  
     | ✓ correct reason |  (2) |
| 8.2 | POQ = 90°  
     | .... (the diagonals of a kite intersect at right angles) | ✓ 90°  
     | ✓ correct reason |  (2) |
| 8.3 | QPO = 20°  
     | .... (the longer diagonal bisects the angles of a kite) | ✓ QPO = 20° with correct reason  
     | ✓ QPS = 20° + 20° = 40° | ✓ QPS = 40°  
     |  (2)  
     | [6] |


**QUESTION 9**

| 9.1 | O is the midpoint of BD.    .... (Diagonals of parm BCDE bisect each other) |
|     | F is the midpoint of OE.  .... (Diagonals of parm AODE bisect each other) |
|     | ∴ OF || AB               .... (The line joining the midpoints of two sides in a Δ is || to third side) |
|     | ✓ O is the midpoint of BD  
|     | ✓ reason – diagonals of parm  
|     | ✓ F is the midpoint of OE  
|     | ✓ reason – midpoint theorem |
|     | ✓ AE || OB                 
| 9.2 | ✓ reason – opp sides parallel |
|     | ✓ OF || AB               .... (proven above) |
|     | ✓ OE || AB               .... (proven above) |
|     | ∴ ABOE is a parallelogram .... (both pairs of opposite sides of quad are parallel) |

| 9.3 | In ΔABO and ΔEOD |
|     | 1. AB = EO     ...(Opp sides of parm ABOE are equal) |
|     | 2. AO = ED     ...(Opp sides of parm AODE are equal) |
|     | 3. BO = DO     ...(Diagonals of parm BCDE bisect each other) |
|     | ∴ ΔABO ≡ ΔEOD  (S, S, S) |

|     | ✓ AB = EO  
|     | ✓ AO = ED  
|     | ✓ reason – opp sides are equal  
|     | ✓ BO = DO  
|     | ✓ reason – diagonals of parm |

**TOTAL:** 100